

IMPLICIT ASSOCIATIONS BETWEEN PAIN AND SELF-SCHEMA IN CHRONIC  
PAIN PATIENTS

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## ABSTRACT

Chronic pain often interferes with daily functioning, and may become a threat to an individual's sense of self. Despite the development of a recent theoretical account focussing upon the relationship between the presence of chronic pain and a person's self, research investigating this idea is limited. In the present study we aimed to (1) compare the strength of association between self- and pain schema in chronic pain patients and healthy control subjects and (2) research whether the strength of association between self- and pain schema is related to particular pain-related outcomes and individual differences of chronic pain patients. Seventy three chronic pain patients ( $M_{age}=49.95$ ;  $SD=9.76$ ) and 53 healthy volunteers ( $M_{age}=48.53$ ;  $SD=10.37$ ) performed an Implicit Association Test (IAT) to assess the strength of association between pain- and self-schema. Chronic pain patients also filled out self-report measures of pain severity, pain suffering, disability, depression, anxiety, acceptance and helplessness. Results indicated that the pain- and self-schema were more strongly associated in chronic pain patients than in healthy control subjects. Second, results indicated that, in chronic pain patients, a stronger association between self- and pain schema, as measured with the IAT, is related to a heightened level of pain severity, pain suffering, anxiety and helplessness. Current findings give first support for the use of an IAT to investigate the strength of association between self- and pain schema in chronic pain patients and suggest that pain therapies may incorporate techniques that intervene on the level of self-pain enmeshment.

## INTRODUCTION

Chronic pain often interferes with daily life activities [17,24,45]. Lasting pain may also influence the individual's sense of self (i.e., an individual's self-schema) [5,24,33]. Indeed, the fact that pain persists and remains to interrupt and interfere with daily functioning may be damaging to one's sense of self, and result in suffering [23]. A theoretical account in this context is the schema enmeshment model of pain [33]. A central tenet of this model relates to strength of association between a person's pain- and self-schema (i.e., mental structures constructed through experience used to process incoming stimuli). It is assumed that the repeated and simultaneous activation of the content of the self- and pain-schema, as is the case in chronic pain patients, results in a stronger association between a person's pain- and self-schema. Furthermore, it is proposed that such a strong association is detrimental for pain outcomes (i.e., disability, pain suffering) [21,25,33] or related to chronic pain patient characteristics (e.g., depressive mood, anxiety, acceptance) [25,33,34,37,42]. Research investigating above-mentioned topic is, however, still in its infancy [25].

As yet, the association between pain- and self-schema in chronic pain patients has mainly been investigated by means of explicit (e.g., interview) and semi-explicit measures (e.g., Sentence Completion Test) [42,37,38]. Although these studies provide some evidence for the idea that chronic pain influences the individual's sense of self, there are limitations to the use of (semi-)explicit measures. Indeed, these measures tap only conscious cognitive processes, and explicit measures may be more vulnerable for response bias. Researchers have therefore developed so-called implicit measures that are less susceptible to bias and can reveal associations between schemata even when people are not willing or unable to report those associations [11,30].

The main aim of the current research was to investigate the strength of association between pain- and self-schema in chronic pain patients and healthy control subjects. To assess the strength between self- and pain-schema, we used the Implicit Association Test (IAT) [14]. The basic idea is that people are faster to categorize stimuli related to two associated concepts in the same way (e.g., by pushing the same button) than to categorize these stimuli in a different way (e.g., by pushing a different button) [14]. In this study, participants were required to categorize words related to the self - other dimension (e.g., <participant's first name> - <unfamiliar first name>), and words related to the pain - free of pain dimension (e.g., "excruciating" - "relieving").

We hypothesized that the association between pain- and self-schema, as measured by the IAT, is stronger in chronic pain patients than in healthy control subjects. Furthermore, we also hypothesized that within the group of chronic pain patients a stronger association between pain- and self-schema would be related to worse pain-related outcomes, in particular disability and suffering from pain. Finally, we tested whether IAT scores are related to depressive mood and level of anxiety and acceptance of the chronic pain patients and so replicate previous research using (semi-)explicit measures to assess the overlap between pain- and self-schema in chronic pain patients [25,42].

## **METHOD**

### **Participants**

Chronic pain patients were recruited via an invitation letter sent to the members of the Flemish Pain League. Five-hundred and eighteen members responded to the letter, of which 315 agreed to be contacted by phone. In the period February-March 2011, two hundred sixty-seven persons were actually

contacted by telephone. Inclusion criteria for chronic pain patients were: (1) aged between 18 and 65 years; (2) sufficient knowledge of the Dutch language; and (3) suffering from pain that lasted for at least six months. Individuals were excluded when headache was the most important pain (cfr. [12]), when they were unable to use both index fingers, or when their eyesight was not normal or corrected-to-normal (e.g., by glasses) [46]. Eighty-one chronic pain patients who fulfilled the criteria agreed to participate. Because participants needed to travel to the university campus to participate in this study, transportation problems were mentioned as the most frequent reason for non-participation. However, later on, a further seven patients decided not to participate because of health problems, and one participant could not execute the IAT because of insufficient time to complete the task during the experiment session. The final chronic pain sample consisted of 73 individuals. A control group matched for age and gender (on group level) was recruited via advertisement in a local newspaper and via flyers. A total of 86 individuals contacted the researcher to participate in the study. Inclusion and exclusion criteria were similar as in the chronic pain group, except for (1) age range which was between 21 and 65 years (due to matching with chronic pain patients) and (2) participants should not report current pain problems. A total of 54 participants were eligible to participate in the study. The main reasons for exclusion were age range ( $n=13$ ) and presence of a current pain problem ( $n=12$ ). The final healthy control sample consisted of 53 individuals.

Both groups were recruited as part of the Ghent Pain and Disability Study I (GPD-I-study). A flowchart and more details of the recruitment and procedure of the GPD-I-study are available on following website: <http://hdl.handle.net/1854/LU-3050986>. The study design was approved by the Ethics Committee of the Faculty of Psychology and Educational Sciences of

Ghent University and written informed consent was obtained from all participants. All participants received a monetary reward for their participation.

### **Questionnaires**

*Disability* was assessed by means of the Dutch version of the Pain Disability Index (PDI; [35]). In this questionnaire, participants are asked to indicate the extent of disability experienced in seven areas of everyday life (e.g., family/home responsibilities and social activity) using 0–10 Likert scales (0 = no disability and 10 = total disability). Scores range from 0 to 70. The reliability and validity of the PDI have been well established [43]. In the present study Cronbach's alpha of the PDI was .81.

*Depressive and anxious mood* were measured with the Hospital Anxiety and Depression Scale (HADS; [48]). The HADS is a self-report scale that screens for the presence of depression and anxiety during the past week. The HADS was especially designed to measure depression and anxiety among patients with "medical conditions" [48]. The HADS-D (depression subscale) consists of seven items that are rated on a 4-point Likert scale (e.g., I feel cheerful). Scores vary between 0 and 21. Also the HADS-A (anxiety subscale) consists of seven items that are rated on a 4-point Likert scale (e.g., I feel tense or wound up). Again scores vary between 0 and 21. The HADS was found to perform well in assessing the symptom severity of depression and anxiety in somatic and primary care patients [3]. Cronbach's alpha of the HADS-D and HADS-A in the present study were .82 and .80 respectively.

Participants' level of anxiety was furthermore also assessed via the Dutch version of the State-Trait Anxiety Inventory (STAI; [40,47]) because the STAI measures anxiety in a more elaborated way than the HADS-A. Indeed the STAI

measures *State anxiety* as well as *Trait anxiety*. The STAI-trait (STAI-T) subscale measures the disposition toward anxiety as a personality trait, which is defined as the relatively stable individual difference in anxiety proneness. The STAI-state (STAI-S) subscale measures the intensity of anxiety as a current emotional state consisting of subjective feelings of tension, nervousness, apprehension, and worry, and activation or arousal of the autonomic nervous system. The STAI consists of 40 items in which people are asked to report their feelings in general (e.g., I feel happy) and at present (e.g., I feel upset) using a 4-point Likert scale. Scores for the state and the trait version vary between 20 and 80. This questionnaire consistently demonstrated adequate psychometric properties and is among the most commonly used measures of anxiety [2,9,26,27,41]. In the present study, Cronbach's alpha of the STAI-S (STAI state version) and STAI-T (STAI trait version) were .94 and .94 respectively.

*Pain severity* and *Pain suffering* were assessed with the Multidimensional Pain Inventory (MPI; [18,19]). Part I of the MPI consists of five subscales assessing the impact of pain (i.e., pain severity, pain interference, social support, perceived life control and affective distress). Pain severity was assessed by means of two items (i.e., "Rate the level of your pain at the present moment" and "On average, how severe has your pain been during the last week."). We opted to use only two items of the MPI severity subscale because the third item (i.e., How much suffering do you experience because of your pain?) relates to suffering rather than pain severity (see [32]). This item was coded and reported as pain suffering. The reliability and validity of the MPI have been well established [36]. In the present study Cronbach's alpha of the MPI pain severity subscale was .95.

*Helplessness* (i.e., the tendency to focus on the adverse aspects of the

disease/pain and to generalize them to daily functioning) and *Acceptance* (i.e., the tendency to recognize the need to adapt to a chronic disease/pain while perceiving the ability to tolerate and manage its aversive consequences) were assessed using the 6-item Helplessness subscale and the 6-item Acceptance subscale of the of the Illness Cognitions Questionnaire (ICQ; [10]) respectively. The ICQ showed a good reliability and validity [20]. In the present study, Cronbach's alpha of the Helplessness subscale and the Acceptance subscale of the ICQ were .85 and .90 respectively.

### **Word Stimuli**

The 'self' category was represented by three words characterising the participant (his/her first name, his/her surname, and his/her place of residence). The 'other' category was represented by the first name, surname, and place of residence of a completely unknown and fictive person chosen by participants from a set of possible stimuli. The pain- and 'free of pain'- categories were each represented by three adjectives representing these dimensions (pain: excruciating [kwellend], horrible [vreselijk], exhausting [uitputtend]; free of pain: relaxing [ontspannend], relieving [bevrijdend], lenitive [verzachtend]). Pain-related adjectives were derived from the McGill Pain Questionnaire [22]. The adjectives belonging to the 'free of pain'- category were derived from previous IAT-research [16].

-INSERT FIGURE 1-

### **Implicit Association Test**



In line with Greenwald and colleagues (2003) [15], the IAT consisted of 7 blocks, of which the third and fourth as well as the sixth and seventh were critical. Each block started with the presentation of the relevant category-labels for 3000ms. Labels were “me [ik]” and “not-me [niet-ik]” for the self-other dimension, and “pain [pijn]” and “free of pain [pijnvrij]” for the pain - free of pain dimension. In each block, the relevant labels were shown in the upper left and right corners of the screen. The labels remained on the screen for the entire duration of each block (see Fig. 1). In the first block, participants practised the discrimination between self and other stimuli. Each ‘self’- and ‘other’- related word was presented four times (i.e., 24 trials). In the second block participants practised the discrimination between ‘pain’- and ‘free of pain’- stimuli. Each ‘pain’- and ‘free of pain’- related word was presented four times (i.e., 24 trials). The third and fourth block were the self-pain blocks. In these blocks, participants categorised as quickly and as accurately as possible the words of all four categories. Pain words were categorized by pressing the same key that was used for ‘self’- related words, whereas ‘free of pain’- words were categorized by pressing the same key that was used for ‘other’- related words. Each word was presented four times in each of the self-pain blocks (i.e., 48 trials/block). In the fifth block, participants needed to categorize only ‘pain’ and ‘free of pain’- related stimuli. However, the response mapping for the categories was reversed, assigning pain words to the ‘other’ key and ‘free of pain’-words to the ‘self’ key. During this block each word was presented six times (i.e., 36 trials). In Blocks 6 and 7, participants again categorised as quickly and as accurately as possible the words of all four categories, using the other-pain response mapping. Pain words were now categorized by pressing the same key that was used for ‘other’- related words, whereas ‘free of pain’- words were categorized by pressing the same key that

was used for 'self'- related words. Again each word was presented four times (i.e., 48 trials/block). Because we were primarily interested in interindividual differences in IAT effects, all participants completed the blocks in an identical sequence (see Table 1). The order of the presentation of the words within a block was completely random.

-INSERT TABLE 1-

### **Procedure**

Before the experimental session started (i.e., at the moment of scheduling the experiment session), chronic pain patients (but not healthy volunteers) were invited to fill out a set of questionnaires at home (e.g., MPI, HADS, PDI, STAI-T, demographic information). They completed the questionnaires either online (via LimeSurvey), either on paper. Upon arrival all participants received general information about the study, signed an informed consent form and filled out the STAI(-S). Thereafter, all participants performed several experimental tasks as part of the GPD-I study of which the IAT was one. During the IAT, on each trial a stimulus word appeared in the centre of the screen in white letters (Courier New, font size 14pt) on a black background. Each word had to be assigned as quickly and as accurately as possible to one of the category labels ("me", "not-me", "pain", "free of pain") presented in the upper left and right corners of the screen by pressing the keys "A" for a left and "P" for a right response. If participants made a mistake, the message "wrong" appeared in red above the stimulus for 400ms. The inter-trial-interval varied randomly between 600 and 750ms. Upon completion of the IAT, participants completed the ICQ and a manipulation check on which chronic pain patients scored the 'pain' and 'free of pain' – related words

on relevance for their particular pain on an 11-point likert scale (0 = not at all relevant; 10 = very much relevant).

### **Data Handling**

In line with the present IAT-literature, IAT scores were calculated by using the most often reported D600 scoring algorithm for IAT data, which has been shown to outperform conventional scoring algorithms [15]. When calculating the D600 index, which is the difference in RT between compatible and incompatible blocks, one has to include RTs on (mixed) practice blocks, add a 600ms penalty (i.e., error penalty) to RTs on trials with incorrect responses, and correct the latencies for individual variability [15]. We implemented the algorithm in such a way that a positive D600 score reflects a stronger association between 'self' and 'pain' and 'other' and 'free of pain' than between 'self' and 'free of pain' and 'other' and 'pain' (i.e., a strong association between pain schema and self-schema). A negative score reflects stronger associations between 'self' and 'free of pain' and 'other' and 'pain' than between 'self' and 'pain' and 'other' and 'free of pain' (i.e., less strong association between pain schema and self-schema). Participants with error rates higher than 30% were treated as invalid and excluded from analyses. No participants needed to be excluded based on this criterion. As some individual difference variables (e.g., pain severity) did not have a normal distribution, we reported spearman correlations when investigating the relationship with the D600 measure. Whenever possible effect size-indices for independent samples and the 95% Confidence Interval (95% CI) were calculated [4,6].

## **RESULTS**

## Participant Characteristics

The mean age of the participants was 49.35 years ( $SD = 10.01$ ; range 21-65 years) and 83 of them were female (65.9%). Furthermore, a majority of the participants were married (52.0%) or living together (8.8%). Almost half of the participants graduated from high school or university (49.6%). In the chronic pain patients, the median pain duration was 144.00 months ( $IQR = 161.00$ ). Chronic pain patients and healthy controls did not differ in terms of age or gender, but did differ significantly for education level and marital status (See table 2 for an overview). Chronic pain patients reported a mean disability level of 39.58 ( $SD = 11.32$ ) on the PDI. Furthermore, they reported a mean pain level of 3.78 on the MPI ( $SD = 1.06$ ). Almost all participants reported more than one pain location ( $M = 3.82$ ,  $SD = 1.89$ ; range = 1-9). Most commonly reported were back pain (90.4%), neck pain (67.1%), leg pain (65.8%) and arm pain (46.6%).

-INSERT TABLE 2-

## IAT

First, ratings of the manipulation check indicated that the allocation of words to the 'pain'- and 'free of pain'-category was appropriate. Chronic pain patients reported that adjectives related to the pain category ( $M = 6.94$ ,  $SD = 1.66$ ) were more relevant for their pain compared to the adjectives that were allocated to the 'free of pain' - category ( $M = 3.09$ ,  $SD = 2.31$ ;  $t(71) = 12.75$ ,  $p < .001$ ,  $d = 1.90$ , 95%  $CI = 1.41: 2.39$ ). Next, we performed a one-way ANOVA with Group (chronic pain, healthy control) as between-subjects variable and D600 IAT score as dependent variable. Results indicated a main-effect of Group ( $F(1,124) = 30.16$ ,  $p < .001$ ;  $d = 0.99$ , 95%  $CI = 0.62: 1.37$ ), indicating that D600 IAT score

was larger in the chronic pain group ( $M = .12$ ,  $SD = .51$ ) than in the healthy controls ( $M = -.33$ ,  $SD = .35$ ). To control for a possible baseline effect of Education level and marital status analyses were repeated with both variables included as covariate. No influence of both variables was found (All  $F_s < 1.55$ ) and the main effect of Group remained present ( $F(1,122) = 24.49$ ,  $p < .001$ ).

### **Correlational Analyses**

For the chronic pain patients, we calculated Spearman correlation coefficients between the D600 index and other individual difference measures (i.e., pain duration, state anxiety, trait anxiety, depression, disability, pain severity, pain suffering, helplessness, and acceptance; see Table 3). Results showed that pain severity (MPI-sev;  $r = .23$ ,  $p = .05$ ), pain suffering (MPI-suf;  $r = .35$ ,  $p < .01$ ), state anxiety (STAI-S;  $r = .28$ ,  $p < .05$ ) and trait anxiety (STAI-T;  $r = .32$ ,  $p < .01$ ) correlated significantly with the D600 index, indicating that chronic pain patients with a stronger association between pain- and self-schema were also more anxious and reported more severe pain and suffering. Furthermore, we also found that the level of helplessness (ICQ-help;  $r = .29$ ,  $p < .05$ ) correlated significantly with the IAT index, indicating that a stronger association between pain and self-schema is related to increased feelings of helplessness.

-INSERT TABLE 3-

### **DISCUSSION**

The main findings of the current study can be readily summarized. First, the pain- and self-schema were more strongly associated in chronic pain patients than in healthy control subjects. Second, results indicate that, in chronic pain

patients, a stronger association between self- and pain-schema relates to a heightened level of pain severity, pain suffering, (state and trait) anxiety and helplessness. In contrast with previous research, using explicit measures to assess the strength of the association between pain- and self-schema, no significant relationship was found between the strength of the association between pain- and self-schema and the level of acceptance or depression. Each of these findings deserves further attention.

First, results showed that the IAT-index differed significantly between healthy controls and chronic pain patients, indicating that pain- and self-schema are more strongly associated in chronic pain patients than in healthy control subjects. This is in line with the idea that, although a schema (in this case the person's self-schema) within a person is relatively stable over time, repeated simultaneous presentation of elements from the pain- and self-schema may result in (partial) incorporation of one schema into another schema. The current finding is also in line with the schema-enmeshment model [33] which states that the self- and pain-schema become enmeshed to some degree in chronic pain patients. Based on this idea, it might also be expected that for people who experience more severe pain, a simultaneous presentation of elements from pain- and self-schema will be more pronounced and thus result in a stronger association between these schemata. Results of the current study indeed point in this direction and indicate that a stronger association between pain- and self-schema is related to higher levels of pain severity (MPI) in chronic pain patients (see also [25]).

Second, the strength of the association between pain- and self-schema was related to the level of suffering, anxiety and the feeling of helplessness of the chronic pain patients, but not to the level of acceptance. The fact that our IAT

measure is related to higher levels of anxiety and suffering of the chronic pain patients is in line with previous research using explicit measures (e.g., [42]) and assumptions of the schema-enmeshment model [33]. Indeed, the schema-enmeshment model suggests that stronger associations between pain- and self-schema could maintain and exacerbate anxiety/distress because the unique ability of pain to interfere with cognitive functioning and interrupt most aspects of life [33]. Therefore, it could also be expected that the strength of association between pain- and self-schema would be related to the level of disability and suffering in chronic pain patients. The current study indeed revealed that the strength of association between pain- and self-schema is positively related with patients' level of suffering, suggesting that indeed the enmeshment of pain- and self-schema relates to enlarged suffering in chronic pain patients. The expected relationship with disability, however, failed to reach significance in this study.

Furthermore, in contrast with previous studies investigating the relationship between depression and the strength of association between self- and pain schema, results of this study failed to reach the conventional level of significance ( $p=.07$ ). This inconsistent finding may partially be due to the differences between the current sample and previous samples. The current sample was recruited via a self-help association, whereas the chronic pain populations in previous studies were mainly recruited in pain clinics [25,42]. For example, the level of depression of the current sample ( $M=8.54$ ,  $SD=4.06$ ) was significantly lower than in the sample of Sutherland and colleagues ( $M=9.99$ ,  $SD=4.38$ ;  $t(154)=2.138$ ,  $p<.05$ ,  $d=0.34$ ,  $95\%CI=0.03:0.66$ ). Furthermore, in the current sample only 7 patients could be categorized as severely depressed (HADS-score $\geq 15$ ; [39]), which may have reduced the chances to find a strong correlation between the strength of association between pain- and self-schemata

and the presence of depression. To investigate the relationship with an individual difference measure of interest, future research might try to increase the variability in the study sample or opt to compare pre-selected groups (high versus low) on the characteristic of interest. Also the absence of a relationship between the strength of the association between self- and pain-schema and acceptance is in contrast with previous findings of Morley et al. (2005) who found that higher levels of self-pain-enmeshment were related to less acceptance (see also [42]). One reason may relate to the particular population included in each study. In line with this suggestion, Crombez and colleagues reported that the level of acceptance in a pain clinic sample was lower than in a self-help group [7]. A second reason that may explain the diverging results of the current study and previous research may relate to the different ways in which the self has been conceptualized. Indeed, the self is not a unitary construct. In the current study participants' 'self' has been operationalized at its most fundamental level (i.e., 'me' vs 'not me'), whereas previous studies on self-pain-enmeshment used a more elaborated conceptualization of the self. These studies distinguished between attributes of the current self and attributes of future possible selves [42]. In doing so, the conceptualization of self-pain-enmeshment reflects the anticipation of non-goal attainment because of pain. It would be interesting to replicate our research using adaptations of the IAT that tap into other aspects of the self-concept (e.g., by using labels such as "I want to be" vs. "I do not want to be"; [8]). A last reason that might account for the discrepancy of results between the present study and previous studies investigating self-pain-enmeshment relates to the different paradigms that have been used to assess the strength of association between self- and pain-schemata. It is possible that the IAT we used to investigate the relationship between self- and pain-schema does not measure



the same construct as the (semi-)explicit measures which were assessed in previous research. Indeed, similar research in other domains has shown that dissociations can be found between explicit and implicit measures which assess a similar construct (e.g.,[1,28,44]). An interesting direction for future research would be to combine the assessment of implicit measures and explicit measures of the strength of association between self- and pain schema (1) to investigate whether both measures are related and (2) to investigate which measures are the best predictor for pain outcomes or changes due to pain treatment [13,16]. Finally, this study indicates that a stronger association between pain- and self-schema is related to more feelings of helplessness. To our knowledge this study is the first study to investigate this relationship. Yet, the current finding is in line with the expectations as people are likely to perceive their pain as more uncontrollable when they perceive their pain to be stronger associated with their self-schema.

Present findings may have clinical and theoretical implications. First, our findings offer support for the schema-enmeshment model which suggests that the enmeshment of self- and pain-schema is present in chronic pain patients and that this enmeshment is related to the level of pain severity and suffering [33]. Second, the IAT that we introduced offers an alternative way to assess the strength of the association between pain- and self-schema that is less susceptible to problems of response bias and is not restricted to conscious cognitive processes. Third, our research indicates that a stronger association between self- and pain-schema is related to negative pain outcomes and higher levels of anxiety and helplessness. This latter finding suggests that pain therapies may benefit from the inclusion of techniques that intervene on the level of self-pain-enmeshment. ~~This might for example be achieved by means of acceptance~~

~~based therapeutic strategies, i.e., by enhancing an individual's capability to value non-health related goals in the presence of pain [19,29].~~

Some aspects of the current study require further consideration. First, some correlational findings were of a small effect size ( $.25 < r < .30$ ). As our study is one of the first of its kind, replication of the current findings is necessary. Second, our research was cross-sectional and therefore cannot make any claim about the causal relationship between variables. To investigate the interesting question of causality, future research might opt to use a longitudinal design. Third, our sample was recruited via an invitation letter. Only 10% actually responded which could have influenced the representativeness of the study sample. The characteristics of the current study sample are, however, comparable with samples of other studies (e.g., [29]). Fourth, in the current IAT, we opted to preselect pain-related stimuli that are commonly used in Dutch. Although a post-hoc manipulation check confirms their relevance for this category, future research might allow people to select the most relevant terms for their particular pain. Fifth, one could argue that the IAT-effect did not reflect associations between schemata but merely the extent to which self- and pain-items are similar in terms of familiarity. Previous research on the IAT, however, demonstrated that overlap in terms of familiarity has little or no impact on IAT effects [31]. Last, although post hoc power analyses indicated that the current study had sufficient power ( $\pi > .80$ ) to detect moderate effects ( $r \geq .3$ ), small effects may have been missed due to a lack of statistical power.

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## REFERENCES

- [1] Asendorpf JB, Banse R, Mücke D. Double dissociation between implicit and explicit personality self-concept: The case of shy behavior. *J Pers Soc Psychol* 2002;83:380-393.
- [2] Barnes LLB, Harp D, Jung WS. Reliability Generalization of Scores on the Spielberger State-Trait Anxiety Inventory. *Educ Psychol Meas* 2002;62:603-618.
- [3] Bjelland, I, Dahl AA, Haug TT, Neckelmann D. "The validity of the Hospital Anxiety and Depression Scale. An updated literature review". *J Psychosom Res* 2002;52:69–77
- [4] Borenstein M, Hedges LV, Higgins JPT, Rothstein HR. Introduction to meta-analysis. West Sussex: Wiley; 2009.
- [5] Clyde ZK, Williams AC. Depression and mood. In: Linton SJ, editor. *New avenues for the prevention of chronic musculoskeletal pain and disability. Pain research and clinical management, vol. 12.* Amsterdam: Elsevier; 2002. p. 105–121.
- [6] Cohen J. *Statistical power analysis for the behavioural sciences.* San Diego: McGraw-Hill, 1988.
- [7] Crombez G, Eccleston C, Van Hamme G, Vlieger P. Attempting to solve the problem of pain: A questionnaire study in acute and chronic pain patients. *Pain* 2008;137:556-563.
- [8] Dewitte, M., & De Houwer, J. (2008). Proximity and distance motives in adult attachment. *Eur J Personality*, 22, 675-694
- [9] Edwards RR, Doleys DM, Fillingim RB, Lowery B. Ethnic Differences in Pain Tolerance: Clinical Implications in a Chronic Pain Population. *Psychosom Med* 2001;63:316–323.

- [10] Evers AWM, Kraaimaat FW, van Lankveld W, Jongen PHJ, Jacobs WWG, Bijlsma JWJ. Beyond unfavorable thinking: Illness Cognition Questionnaire for chronic diseases. *J Consult Clin Psychol* 2001;69:1026-1036.
- [11] De Houwer J, Teige-Mocigemba S, Spruyt A, Moors A. Implicit measures: A normative analysis and review. *Psychol Bull* 2009;135:347-368.
- [12] Eccleston C, Williams AC, Morley S. Psychological therapies for the management of chronic pain (excluding headache) in adults (Review). *Cochrane Database Syst Rev* 2009;2:CD007407.
- [13] Gheldof ELM, de Jong PJ, Vinck J, Houben R. Attitudes towards physical activity: the role of implicit versus explicit measures. In: asmundson GJ, Vlaeyen, JWS, Crombez G, Eds. Oxford, UK: Oxford University Press; 2004. p. 117-138.
- [14] Greenwald AG, McGhee JL, Schwartz JL. Measuring individual differences in implicit cognition: The Implicit Association Test. *J Pers Soc Psychol* 1998;74:1464–1480.
- [15] Greenwald AG, Nosek BA, Banaji MR. Understanding and using the implicit association test: I. An improved scoring algorithm. *J Pers Soc Psychol* 2003;85:197-216.
- [16] Grumm M, Erbe K, von Collani G, Nestler S. Automatic processing of pain: the change of implicit pain associations after psychotherapy. *Behav Res Ther* 2008;46:701–714.
- [17] Karoly P, Okun MA, Ruhlman LS, Pugliese JA. The impact of goal cognition and pain severity on disability and depression in adults with chronic pain: An examination of direct effects and mediated effects via pain-induced fear. *Cogn Ther Res* 2008;32:418-433.

- [18] Kerns RD, Turk DC, Rudy TE. The West Haven-Yale Multidimensional Pain Inventory. *Pain* 1985;23:345-356.
- [19] Lousberg R, Van Breukelen GJP, Groenman NH, Schmidt AJM, Arntz A, Winter FAM. Psychometric properties of the Multidimensional Pain Inventory, Dutch language version (MPI-DLV). *Behav Res Ther* 1999;37:167–82.
- [20] Lauwerier E, Crombez G, Van Damme S, Goubert L, Vogelaers D, Evers AW. (2010). The construct validity of the illness cognition questionnaire: the robustness of the three-factor structure across patients with chronic pain and chronic fatigue. *Int J Behav Med* 2010;17:90-96.
- [21] MacDonald MR. Self-pain enmeshment and the perception of pain. *Pain* 2005;118:279-279.
- [22] Melzack R. The McGill Pain Questionnaire: major properties and scoring methods. *Pain* 1975;1:277–99.
- [23] Morley S. The Self in Pain. *Rev Pain* 2010;4:24-27.
- [24] Morley S, Eccleston C. The object of fear in chronic pain. In: Asmundsen G, Vlaeyen J, Crombez G., eds. *Understanding and treating fear of pain*. Oxford: Oxford University Press; 2004. p. 163-188.
- [25] Morley S, Davies C, Barton S. Possible selves in chronic pain: self pain enmeshment, adjustment and acceptance. *Pain* 2005;115:84–94.
- [26] Nelson D, Novy D. Self-report differentiation of anxiety and depression in chronic pain. *J Pers Assess* 1997;69:392–407.
- [27] Nelson F, Zimmerman L, Barnason S, Nieveen J, Schmaderer M. The relationship and influence of anxiety on postoperative pain in the coronary artery bypass graft patient. *J Pain Symptom Manage* 1998;15:102–9.

- [28] Neumann R, Hülsenbeck K, Seibt B. Attitudes towards people with AIDS and avoidance behavior: Automatic and reflective bases of behavior. *J Exp Soc Psychol* 2004;40:543-550.
- [29] Nicholas MK, Asghari A, Blyth FM. What do the numbers mean? Normative data in chronic pain measures. *Pain* 2008;134:158–73.
- [30] Nosek BA, Hawkins CB, Frazier RS. Implicit social cognition: from measures to mechanisms. *Trends Cogn Sci.* 2011;15:152-9.
- [31] Ottaway, S. A., Hayden, D. C., & Oakes, M. A. (2001). Implicit attitudes and racism: Effects of word familiarity and frequency on the implicit association test. *Social Cognition*, 19(2), 97-144.
- [32] Parenteau SC., Haythornthwaite JA.. Assessment of functioning and disability in pain syndromes. In: Ebert MH, Kerns RD. *Behavioral and Psychopharmacologic Pain Management*. New York: Cambridge University Press; 2011. p. 67-81..
- [33] Pincus T, Morley S. Cognitive-processing bias in chronic pain: a review and integration. *Psychol Bull* 2001;127:599–617.
- [34] Pincus T, Santos R, Morley S. Depressed cognitions in chronic pain patients are focused on health: Evidence from a sentence completion task. *Pain* 2007;130:84–92.
- [35] Pollard CA. Preliminary validity study of the Pain Disability Index. *Percept Motor Skills* 1984;59:974.
- [36] Rudy TE. *Multiaxial Assessment of Pain. Multidimensional Pain Inventory. User's manual*. Pittsburgh: Departments of Anaesthesiology and Psychiatry and Pain Evaluation and Treatment Institute, University of Pittsburgh School of Medicine, 1989.

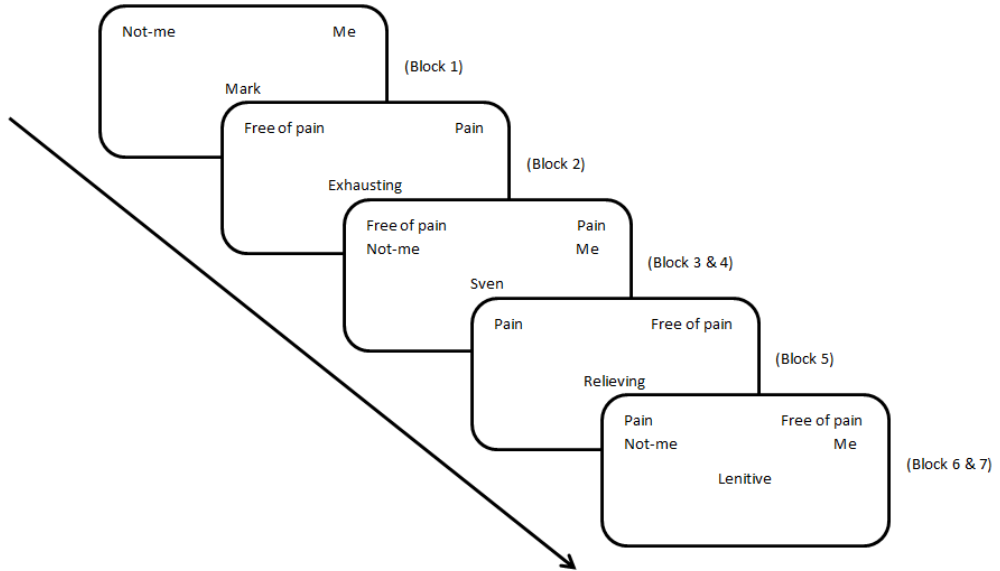
- [37] Rusu AC, Pincus T, Morley S. Depressed pain patients differ from other depressed groups: Examination of cognitive content in a sentence completion task. *Pain* 2012;153:1898-1904.
- [38] Rusu AC, Pincus T. Cognitive Processing and Self-Pain Enmeshment in Chronic Back Pain. In: Hasenbring MI, Rusu AC, Turk DC. *From Acute to Chronic Back Pain: Risk Factors, Mechanisms, and Clinical Implications*. Oxford: Oxford University Press; 2012. p. 315-338.
- [39] Snaith RP, Zigmond AS. *HADS: Hospital Anxiety and Depression Scale*. Windsor: NFER Nelson, 1994.
- [40] Spielberger CD, Gorsuch RL, Lushene RE. *Manual for the State-Trait Anxiety Inventory*. Palo Alto: Consulting Psychologists Press, 1970.
- [41] Spielberger,CD. *Manual for the state–trait anxiety inventory*. Palo Alto: Consulting Psychologists Press, 1983.
- [42] Sutherland R, Morley S. Self-pain enmeshment: future possible selves, sociotropy, autonomy and adjustment to chronic pain. *Pain* 2008;137:366 - 377.
- [43] Tait RC, Chibnall JT, Krause S. The pain disability index: psychometric properties. *Pain*. 1990;40: 171-182.
- [44] Van Bockstaele B, Verschuere B, Koster EHW, Tibboel H, De Houwer J, Crombez G. Differential Predictive Power of Self Report and Implicit Measures on Behavioural and Physiological Fear Responses to Spiders. *Int J Psychophysiol* 2011;79:166-174.
- [45] Van Damme S, Crombez G, Eccleston C. Coping with pain: a motivational perspective. *Pain* 2008;139:1–4.



- [46] Van Ryckeghem DML, Crombez G, Goubert L, De Houwer J, Onraedt T, Van Damme S. The predictive value of attentional bias towards pain-related information in chronic pain patients: A diary study. *Pain* 2013;154:468-75.
- [47] Van der Ploeg HM, Defares PB, Spielberger CD. Handleiding bij de Zelf-Beoordelings Vragenlijst, ZBV. Een Nederlandstalige bewerking van de Spielberger State-Trait Anxiety Inventory, STAT-DY. Lisse: Swets en Zeitlinger, 1980.
- [48] Zigmond AS, Snaith RP. The Hospital Anxiety and Depression Scale. *Acta Psychiat Scand* 1983;67:361–70.
- [49] Zigmond AS, Snaith RP. The HADS: hospital anxiety and depression scale. Windsor, UK: NFER Nelson; 1994.

## FIGURE CAPTIONS

Figure 1. Schematic representation of the IAT.



## TABLES

Table 1 . Trial types IAT

<i>Block nr</i>	<i>Block Name</i>	<i>Trials</i>	<i>Left key</i>	<i>Right key</i>
1	Self – Other - discrimination	24	Other	Self
2	Pain - Free of pain discrimination	24	Free of pain	Pain
3	Self-pain practice block	48	Other + Free of pain	Self + pain
4	Self-pain test block	48	Other + Free of pain	Self + pain
5	Free of pain – Pain -discrimination	36	Pain	Free of pain
6	Other-pain practice block	48	Other + Pain	Self + Free of pain
7	Other-pain test block	48	Other + Pain	Self + Free of pain

Table 2. Participant characteristics

	Chronic pain patients ( <i>N</i> = 73) [ <i>M</i> ( <i>SD</i> )]	Healthy controls ( <i>N</i> = 53) [ <i>M</i> ( <i>SD</i> )]	<i>t</i> -value / $\chi^2$ -value
Age	49.95 (9.76)	48.53 (10.37)	0.78
Gender	65.8% females	66.0% females	.001
Education level	1.4% primary education; 59.2% secondary education; 39.4% higher education	3.8% primary education; 32.7% secondary education; 63.5% higher education	8.61*
Marital Status	61.6% Married; 8.2% Cohabit; 21.9% Alone; 6.8% Divorced; 1.4% Widowed	38.5% Married; 9.6% Cohabit; 26.9% Alone; 25.0% Divorced	11.18*
STAI-S	38.01 (9.39)	29.92 (8.05)	5.06***
STAI-T	47.37 (11.09)	37.74 (10.49)	4.92***

STAI-S = State subscale of the State - Trait Anxiety Inventory; STAI-T = Trait subscale of the State - Trait Anxiety Inventory; \* =  $p < .05$ ; \*\*\* =  $p < .001$

**Table 3**Means (*M*), Standard deviations (*SD*) and Spearman correlation coefficients in chronic pain patients (*N* = 73)

	<i>M</i>	<i>SD</i>	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. IAT index	0.12	0.51	.14	.23	.35**	.20	.22	.21	.28*	.32**	.29*	.02
2. Pain duration	169.77	111.83		-.08	.08	.02	-.07	-.29*	-.20	-.14	-.09	.25*
3. Pain severity (MPI-sev)	3.78	1.06			.46***	.34**	.21	.31**	.07	.18	.34**	-.17
4. Pain suffering (MPI-suf) <sup>1</sup>	4.15	1.21				.52***	.53***	.36**	.22	.43***	.37***	-.39***
5. Disability (PDI)	39.58	11.32					.36**	.21	-.10	.29*	.51***	-.43***
6. Depression (HADS-D)	8.54	4.06						.59***	.42***	.74***	.50***	-.54***
7. Anxiety (HADS-A)	8.67	3.87							.46***	.77***	.40***	-.42***
8. State anxiety (STAI-S)	38.01	9.39								.62***	.30*	-.39***
9. Trait anxiety (STAI-T)	47.37	11.09									.50***	-.65***
10. Helplessness (ICQ-help)	15.56	3.95										-.59***
11. Acceptance (ICQ-acc)	13.83	3.92										1

*Note.* MPI = Multidimensional Pain Inventory; HADS-D = Depression scale of the Hospital Anxiety and Depression Scale; HADS-A = Anxiety scale of the Hospital Anxiety and Depression Scale; PDI = Pain Disability Index; STAI-S = State subscale of the State - Trait Anxiety Inventory; STAI-T = Trait subscale of the State - Trait Anxiety Inventory; ICQ = Illness Cognition Questionnaire ; ICQ, *n* = 72; HADS, *n* = 70; \* = *p* < .05, \*\* = *p* < .01, \*\*\* = *p* < .001.